Claims

[c1]   1. In a database system, a method for recommending database indexes to be created for optimizing system performance, the method comprising:

capturing a workload representative of database queries employed during system use;

creating virtual indexes for optimizing system performance during execution of the database queries captured in the workload;

computing cost benefits for different combinations of the virtual indexes; and

recommending physical indexes to be created based on virtual indexes that have favorable cost benefits for the captured workload.

[c2]   2. The method of claim 1, wherein said virtual indexes comprise in-memory data structures corresponding to sets of potential physical indexes.

[c3]   3. The method of claim 1, wherein the capturing step includes:

displaying a screen input button that a user may invoke to record a usage session as a workload.

[c4]   4. The method of claim 1, wherein the workload represents user execution of a database application with a typical workload that is contemplated for the application.

[c5]   5. The method of claim 1, wherein the workload includes information recording text of all the queries operating during the capture of the workload.

[c6]   6. The method of claim 1, wherein the workload includes information recording settings for certain options that affect how queries are optimized.

[c7]   7. The method of claim 1, wherein the capturing step includes:
capturing information about a set of workloads to define a problem instance.

[c8]   8. The method of claim 1, further comprising:
setting a limit on how much disk space is available for physical indexes.

[c9]   9. The method of claim 8, wherein the recommending step takes into account the limit on disk space available for physical indexes.

[c10]   10. The method of claim 8, wherein the recommending step includes:
if the physical indexes to be recommended for creation

exceed the limit on disk space available for physical indexes, removing some of the physical indexes from consideration.

[c11]   11. The method of claim 10, wherein the physical indexes removed from consideration are ones having less favorable cost benefits for the captured workload.

[c12]   12. The method of claim 10, wherein the physical indexes removed from consideration comprise at least 20 percent of bottom performing indexes considered for recommendation.

[c13]   13. The method of claim 1, further comprising: specifying whether certain types of indexes should be considered at all.

[c14]   14. The method of claim 1, wherein the creating virtual indexes step includes: searching for relevant indexes that will help the system's optimizer use sargable predicates for partial index scans.

[c15]   15. The method of claim 14, wherein the optimizer creates virtual indexes without specifying ordering of columns used in sargable equality predicates.

[c16]   16. The method of claim 1, wherein the creating virtual

indexes step includes:

searching for relevant indexes that will help provide useful orderings.

[c17] 17. The method of claim 16, wherein columns of virtual indexes may be order-independent "don't care" columns that satisfy some interesting ordering wish list of the system's optimizer.

[c18] 18. The method of claim 16, wherein columns of virtual indexes may have an unspecified sortedness.

[c19] 19. The method of claim 1, further comprising:

collapsing some of the virtual indexes together, if feasible for the workload.

[c20] 20. The method of claim 19, wherein the collapsing step includes:

identifying that columns of one virtual index are a superset of another the columns of another virtual index, and that both indexes may be combined into a single virtual index that is feasible for the workload; and identifying that sortedness of a column of a virtual index, if unspecified, may be specified to allow it to be combined with an index with identical columns but specified sortedness; and identifying that a virtual index that has columns of op-

posite sortedness of a second virtual index, and that both indexes may be combined into a single virtual index.

[c21]   21. The method of claim 1, further comprising: polling periodically in the method to ensure that the system is working with accurate cost information.

[c22]   22. A computer-readable medium having processor-executable instructions for performing the method of claim 1.

[c23]   23. A downloadable set of processor-executable instructions for performing the method of claim 1.

[c24]   24. A system that recommends database indexes to be created for optimizing system performance, the system comprising:
a database system that executes database queries; and an index consultant for capturing a workload representative of database queries executed during typical system use; creating virtual indexes for optimizing system performance during execution of the database queries captured in the workload; computing cost benefits for different combinations of the virtual indexes; and recommending physical indexes to be created based on virtual indexes that have favorable cost benefits for the

captured workload.

[c25] 25. The system of claim 24, wherein said virtual indexes comprise in-memory data structures corresponding to sets of potential physical indexes.

[c26] 26. The system of claim 24, wherein the index consultant displays a screen input button that a user may invoke to record a usage session as a workload.

[c27] 27. The system of claim 24, wherein the workload represents user execution of a database application with a typical workload that is contemplated for the application.

[c28] 28. The system of claim 24, wherein the workload includes information recording text of all the queries operating during the capture of the workload.

[c29] 29. The system of claim 24, wherein the workload includes information recording settings for certain options that affect how queries are optimized.

[c30] 30. The system of claim 24, wherein the index consultant captures information about a set of workloads to define a problem instance.

[c31] 31. The system of claim 24, wherein the index consultant may receive information specifying a limit on how much disk space is available for physical indexes.

[c32]   32. The system of claim 31, wherein the index consultant takes into account the limit on disk space available for physical indexes.

[c33]   33. The system of claim 31, wherein the index consultant removes some of the physical indexes from consideration, when sufficient disk space is unavailable.

[c34]   34. The system of claim 33, wherein the physical indexes removed from consideration are ones having less favorable cost benefits for the captured workload.

[c35]   35. The system of claim 33, wherein the physical indexes removed from consideration comprise at least 20 percent of bottom performing indexes considered for recommendation.

[c36]   36. The system of claim 24, wherein the index consultant allows user input specifying whether certain types of indexes should be considered at all.

[c37]   37. The system of claim 24, wherein the index consultant searches for relevant indexes that will help the system's optimizer use sargable predicates for partial index scans.

[c38]   38. The system of claim 37, wherein the optimizer creates virtual indexes without specifying ordering of

columns used in sargable equality predicates.

[c39]   39. The system of claim 24, wherein the index consultant searches for relevant indexes that will help provide useful interesting (order or grouping) properties.

[c40]   40. The system of claim 39, wherein columns of indexes created may reflect order-independent "don't care" columns that satisfy some interesting ordering wish lists of the system's optimizer.

[c41]   41. The system of claim 24, wherein the index consultant attempts to collapse some of the virtual indexes together, if feasible for the workload.

[c42]   42. The system of claim 41, wherein the index consultant attempts to identify that columns of one index are a superset of the columns of another index, and that both indexes may be combined into a single index that is feasible for the workload.

[c43]   43. The system of claim 24, wherein operation of the index consultant may be polled during operation to ensure that the system is working with accurate cost information.